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PUBLIC HEALTH REPORTS.

VOL. XXV. NOVEMBER 11, 1910. No. 45.

PRELIMINARY NOTE ON A SIMPLE AND INEXPENSIVE APPARATUS FOR USE IN SAFE DISPOSAL OF NIGHT SOIL.

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The proper disposal of human excreta is recognized by sanitarians as the most important single measure needed to prevent the spread of typhoid fever, hookworm disease, the dysenteries, and certain other widely prevalent diseases.

Where large numbers of people are gathered together, as in cities, the removal of dejecta from persons becomes, from an esthetic standpoint at least, a necessity, and practically all modern cities have expended large sums of money to install sewerage systems, which, though usually removing the sewage in such a way as to prevent it from becoming an intolerable nuisance to sight and smell, yet frequently fall short of safety from a sanitary standpoint.

Though a city may dispose of its own sewage properly, its people are exposed to excreta-borne infections brought in on various food supplies from farms. Thus the sanitation of the farm is vastly important, not only to the rural population, but also to the urban, and therefore the farm as the fountain head of various and far-flowing streams of infection is the logical point to attack in campaigns of prevention against many of the communicable diseases.[a]

Among the obstacles to progress in farm sanitation, one of the chief has been the difficulty of convincing the farmer that the benefits which would accrue from proper disposal of excreta would justify the expense of constructing and the disagreeable labor of maintaining the sanitary devices proposed. Therefore, whatever can be done in simplification and in lessening expense and labor in the installation and maintenance of an efficient disposal system will increase the chances of its adoption.

The apparatus described in this note has been in use in one of the workrooms of the Hygienic Laboratory since July 12, 1910. It has been seen by a number of sanitarians from different sections of the country, and several of them have expressed a desire to test it for themselves. The details of construction are presented at this time in order to place them at the disposal of any persons who may desire to test the apparatus in question.

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[a] Freeman, Allen W., The Farm the Next Point of Attack in Sanitary Progress. Jour. A. M. A., August 27, 1910.

Starting point of studies.—Starting out on the principle that the forces of nature in fermentation should, if possible, be utilized, we have sought to meet the objections that have thus far occurred to us in respect to the wet system. Further, the importance of economy and of simplicity of construction has been constantly held in mind. An effort has also been made to reduce to a minimum the labor and skill involved in taking care of the privy, and, finally, while sanitary safety has been the chief object in mind, we have not ignored the widespread demand that human excreta be turned to economic account.

Construction.—The apparatus under consideration consists of the following parts:

1. A water-tight barrel to be used as a liquefier.
2. A covered water-tight barrel, can, or other container to receive the effluent.
3. A connecting pipe about 2½ inches in diameter, about 12 inches long, and provided with an open "T" at one end, both openings of the "T" being covered by wire screens.
4. A tight box, preferably zinc lined, which fits tightly on the top of the liquefying barrel; it is provided with an opening on top for the seat, which has an automatically closing lid.
5. An antisplashing device consisting of a small board placed horizontally under the seat and 1 inch below the level of the transverse connecting pipe; it is held in place by a rod, which passes through eyes or rings fastened to the box, and by which the board is raised and lowered. The liquefying tank is filled with water up to the point where it begins to trickle into the effluent tank.

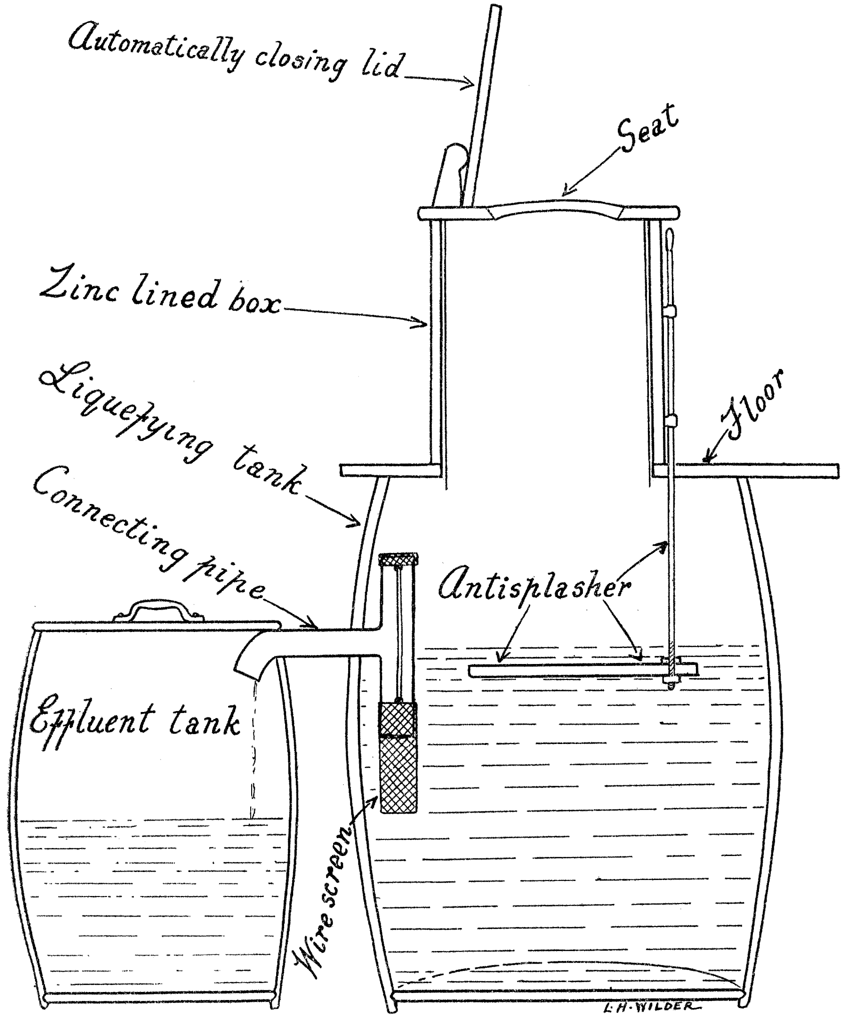
As an insect repellant a thin film of some form of petroleum may be poured on the surface of the liquid in each barrel.

Practical working of the apparatus.—When the privy is to be used, the rod is pulled up so that the antisplashing board rises to within about 1 inch below the surface of the water. The fecal matter falls into the water, but this board prevents splashing, and thus meets one of the greatest objections thus far raised to the wet system. After defecation the person sinks the antisplashing board by depressing the rod, and the fecal matter then floats free into the water. We are now working on an improvement whereby the rod will connect with the automatically closing lid, and the antisplashing board will rise and sink as the lid is opened and closed.

Although some of the fecal matter floats, it is protected both from fly breeding and fly feeding, in the following ways: First, by the automatically closing lid; second, by the water; third, by the film of oil; and fourth, for additional safety, the apparatus should be located in a screened place. The film of oil also prevents the breeding of mosquitoes in the barrel. Accordingly, so far as the privy as a breeding or feeding place for flies and mosquitoes is concerned, the model in question completely solves the problem.

The fecal material becomes fermented in the water and gradually liquefies; the addition of excreta naturally raises the level of the liquid, and the excess flows into the effluent tank, where it is protected from insects by the cover and by the film of oil. This effluent may be allowed to collect in the tank until it reaches the level of the connecting pipe, when it may be safely disposed of in various ways to be discussed later.

From July 12 to October 26 there have been 246 defecations (with urination) into the model in question, making about $2\frac{1}{3}$ defecations a day. The effluent has amounted to about 12 gallons of a manageable fluid. It has not been found necessary to add water to the liquefying barrel since the apparatus was put into operation.



Although the period in question included the hottest part of summer, the odor when compared with that of the average privy has been negligible.

It is thus seen that this device appears to meet the following requirements:

1. It solves the fly and mosquito problems, so far as the privy is concerned.

2. It liquefies fecal matter and reduces its volume so that it may be safely disposed of more easily and cheaply than night soil.
3. It reduces odor.
4. It reduces the labor of cleaning the privy and makes this work less disagreeable.
5. It is of simple and inexpensive construction.

The effect of the fermentative changes in the apparatus upon the viability of typhoid bacilli and hookworm eggs has not been determined, but other experiments tend to show that under such conditions the vast majority of typhoid bacilli and of hookworm eggs introduced would die within six weeks to two months time. While the time of storage can be prolonged according to the capacity of vessels provided for the purpose, we believe at present that it is safer and more practical not to depend upon storage alone to destroy infectious organisms in the effluent, but to consider the effluent infectious and to dispose of it accordingly.

Disposal of effluent.—(1) Heat: If a suitable (metallic) vessel is provided to receive the effluent, a fire may be built under the vessel and the effluent heated to boiling. Or if a wooden or concrete effluent tank is used, the effluent may be transferred to some other vessel for boiling.

After boiling, the fluid may be safely used for fertilizer under any conditions.

Heat disinfection is the only measure which can to-day be recommended unreservedly.

(2) Burial: Burial will unquestionably decrease the dangers of spreading infection, but in the present state of our knowledge this method of disposal can not be relied upon as safe. If burial of the effluent is practiced, the fluid should be disposed of not less than 300 feet from and down hill from any neighboring water supply and not less than 2 feet underground, and then only provided the soil itself is a good filter. Burial in a limestone region may contaminate water supplies miles away.

(3) Chemical disinfection: Chemical disinfectants, such as chlorinated lime and certain coal-tar derivatives, have the great advantage of cheapness and can be relied upon to destroy pathogenic bacteria. Our knowledge regarding the action of chemical disinfectants upon the eggs and spores of the various animal parasites is at present very rudimentary, but so far as results are known, their practicable use does not seem to be so efficient in the destruction of the zooparasitic as of the bacterial infectious organisms. Therefore, pending further investigations, the use of chemically treated excrement as fertilizer should not be regarded as unqualifiedly safe.

(4) Chemical disinfection with subsequent burial: Inasmuch as chemical disinfection can be relied upon to destroy pathogenic bacteria, and inasmuch as burial greatly reduces the danger from animal parasites, a suitable combination of the two methods (chemical disinfection and burial) can be used with reasonable safety.

(5) Sewers: In partially sewered towns, the effluent from these privies may be emptied into the sewers. If conditions are such that the addition of this material to the sewage is dangerous, then the entire sewerage system needs correction.

Paper.—Only toilet paper so far has been used, and the septic action seems to digest it. Other experiments indicate that news-paper would be disposed of by septic action in the tank, but perhaps some increase in the size of the tank would be required.

Cleaning.—Although no water has been added since the model was put into operation, the contents of the liquefying tank have remained fluid, and it is probable that in a tank having the capacity of an oil barrel, the amount of sludge from the dejecta of a family of five people would not be sufficient to require the cleaning of the liquefying tank oftener than once in six months to a year.

Further experiments.—At present our studies are taking the following general directions:

While the barrel as the liquefying tank doubtless will be found to be the most feasible in many localities, it seems probable that tanks made of concrete or other durable material will be more satisfactory in certain instances, and we are now having concrete models built.

We are also planning the construction of a series of privies of this type all of which shall connect with a common effluent pipe so as to have one common effluent tank. A system of this kind appears to be of special applicability to small villages, such as cotton-mill settlements. The effluent tank would be at the lower end of the row, and should be attended to by the proper authorities.

A third line of study is being made with a view to determining the possibility of utilizing safely the effluent for economic purposes. The effluent tank can be filled with gravel and soil, and possibly some plant may be found which will be able to grow in this material, perhaps thus safely utilizing the fecal material as fertilizer. If a suitable plant can be found, it is clear that the labor of disposing of the effluent will be eliminated, and if the plant is of economic value, one, for instance, which could be used as food for live stock, an additional inducement can be offered to the farmer to live a more sanitary life.

The device should be regarded as being still in the experimental stage, but so far as the experiments have gone the results are promising and indicate that with some modification of details to meet different conditions the apparatus may have a wide range of usefulness.